

Minecraft® on Demand – A new IGN service which combines game and 3D cartography

François Lecordix,¹ David Fremont,² Moez Jilani,¹ Emmanuel Séguin,¹ Sofiane Kriat¹

1. Institut national de l'information géographique et forestière, Saint-Mandé, France;
francois.lecordix@ign.fr, emmanuel.seguin@ign.fr, moez.jilani@ign.fr, sofiane.kriat@ign.fr

2. david@developpeur2000.com

Abstract: The French national mapping agency, Institut national de l'information géographique et forestière (IGN), decided to develop a new web service, called Minecraft on Demand (www.ign.fr/Minecraft), designed to provide Minecraft maps from the geographic data that IGN produces. This free web service enables the user to select the center of the map and to get a Minecraft world of 5 km long and 5 km wide, at the scale 1:1. The player can easily input this map into Minecraft, the world's most popular video game with 121 million copies sold. Launched in June 2016 in France, the service Minecraft® on Demand obtained a fair success (10,000 maps downloaded), more specifically among young people, since it may enable them to discover IGN data and geography.

Keywords: Minecraft, Game, Cartography, 3D

1. Introduction

With more than 121 million copies sold in February 2017 (Gilbert 2017), Minecraft is the most sold video game in the world. Launched officially in 2011 by Mojang Company and bought by Microsoft in 2014, Minecraft reaches a large public of young people (8- 30 years old) and is a major opportunity for education and training in many countries. This “21st century virtual Lego” which allows building, online and with many players, worlds or maps had to draw attention of national mapping agencies (NMA).

For instance, in 2013 the summer intern Joseph Braybrook at Ordnance Survey (OS) produced the Minecraft world of Great Britain with OS OpenData products: OS Terrain 50 (a 50 m x 50 m digital terrain grid, with vertical resolution of 10 meters) to create the terrain; the backdrop map product OS VectorMap District to modify the material of the last block on the Minecraft world surface. In September 2014, a second version of this Minecraft world was proposed using a more detailed OS map: 1:25,000 scale OS VectorMap District. With 83 billion blocks, this

map of Great Britain is believed to be the largest Minecraft map in existence built using real-world geographic data (220,000 km²) (Ordnance Survey 2014).

In April 2014, the NMA of Denmark, KMS, also proposed Minecraft worlds using real-world geographic data. KMS decided to use not only the relief of Denmark - which is flatter than Great Britain - but exploited as well their 3D geographic database. (and not 2D maps) and chose to produce this map at 1:1 scale (1 block for 1 m³ on the field). The country was divided in 3 regions and distributed on 3 Minecraft servers: North Jytland server, South Jytland server and Zealand server. Anyone could connect to these servers and play. A second option to obtain maps, still available on KMS website (KMS 2014) is to load Minecraft world on an area of 10 km x 10 km, at 1:1 scale. All these areas are pre-computed by KMS and stored on their website to be downloaded by players.



Fig. 1. Geographic data in Minecraft from OS (Great Britain) and KMS(Denmark) (Source: <http://www.bbc.com/news/technology-24177844>
<https://download.kortforsyningen.dk/content>)

In France, the NMA Institut national de l'information géographique et forestière (IGN) tested in 2013 to introduce geographic data in Minecraft map on the French Island La Réunion only with altimetric data. In September 2015, IGN wished to go further and to experiment the delivery of Minecraft maps which would be easily playable and could make use of a lot of IGN geographic data, available on the whole France.

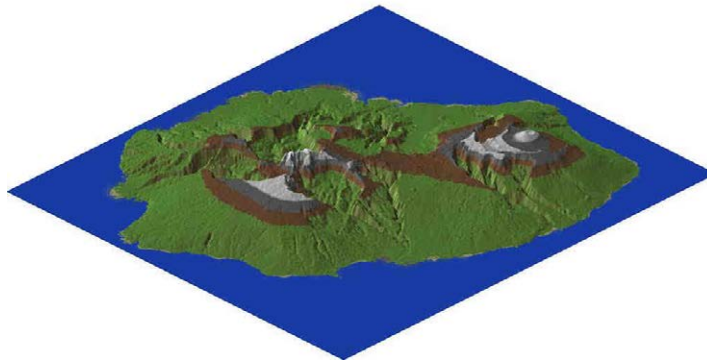


Fig. 2. First experience at IGN to produce Minecraft map with altimetric data on La Réunion

This paper will present first the aims which encourage continuing on this subject and will detail then the work that IGN realized between October 2015 and May 2016 to propose a new service for Minecraft. The results that IGN obtained will be presented in the next part and some perspectives will be outlined.

2. Aims

The first IGN Minecraft map was not really used by many players and it was only a test. But the IGN Marketing Service considered that IGN Minecraft maps would be an excellent product to promote IGN data for young people: when we interview school pupils in France – and probably in other countries –, around 100% of pupils will indicate that they use for cartography Google data, and not data from the NMA, and between 80 and 90 % of pupils know the game Minecraft. So the introduction of IGN geographic data in Minecraft seems to be an excellent solution to reach a wider audience.

In October 2015, IGN decided to launch a new experimentation to produce Minecraft maps. These maps would have to be actually playable by Minecraft players and should use IGN 3D data which are available on whole France. IGN entrusted its incubator *IGNfab* - the unit for innovation and experimentation - to fulfill this.

Due to Minecraft's technical constraints (restricting-heights at 255 blocks, limitations on size of maps to be playable,...) and after examination of OS and KMS and experiences, *IGNfab* immediately decided to develop a Minecraft service on demand - similar to his very popular IGN service Map on demand - which allows the user to select the center of the map and to obtain a Minecraft map of 5 km long and 5 km wide at 1:1 scale (1 block for 1 m³). Once decided, the web service development was conducted with AGILE approach:

- a Product owner (Sofiane Kriat), experimented in Minecraft, who was able to adapt the product specifications in using the Minecraft maps and testing with many players ;
- 2 experimented developers for engine to compute maps (David Fremont) and for the web interface (Moez Jilani);
- 2 project managers with experience on IGN data (François Lecordix) and web services (Emmanuel Seguin).

3. Development

To develop this new service Minecraft® on Demand, the job was divided in two parts: the engine and the interface.

3.1 Engine Development

The first step of development in Java focused on an engine for 3D Minecraft maps redaction from IGN data sources. The data are available with IGN Geoportail data flows (WMS and WFS). For the 3D redaction, with Minecraft blocks of 1 m³, the different geographic layers are introduced in a specific order to represent first the relief and then the remaining layers information: land covers, rivers, roads, buildings, etc.

The different data used to produce the maps, as realistically as possible, comes from IGN geographic database available on Geoportail:

- RGE ALTI®: this database which provides a digital terrain model (DTM) with a 1 m resolution is used to generate the topographic relief on Minecraft map. Due to Minecraft's technical constraints (restricting-heights at 255 blocks), it is necessary to introduce a scale factor for the difference in height that we can obtain in France in particular in mountain area, the Alpes for instance: 4,000 meters around the Mont-Blanc. The scale factor is non linear and depends on the bounding box selected by the user and the height differences in the rectangular area of 5 km x 5 km.
- BD CARTO®: this vector database provides a continuous land cover on whole France with a resolution of 10 meters. Different information on artificial surfaces, agricultural areas, forest and semi natural areas, wetlands, water bodies are provided and introduced in Minecraft.
- Référentiel parcellaire graphique (RPG): this non continuous vector database is realized by farmers for the Minister of agriculture and the European Community. RPG provides different cultures in agricultural areas and consequently provides more information than BD CARTO® to distinguish cultures.
- BD ORTHO®: this orthophoto database is used only to extract colorimetric information, for example the roofs and gardens colors. With these colors, it is possible to select different kinds of blocks in Minecraft maps in order to introduce even more realistic representation.
- BD TOPO®: this vector topographic database, with a resolution of 1 meter and 3D information, is used to generate blocks of roads, rivers, buildings, etc. The information on elevation of buildings in BD TOPO® is used to compute the building elevation in Minecraft map.

All these data are used via data flows that the API Geoportail proposes to developers. With this solution, the users will always use the last version of data available on Geoportail. To complete some areas with data that are not available in the different databases on Geoportail (for instance information to produce paper maps at 1:25,000 scale), the process of Minecraft maps production uses data stored in cartographic database. For the buildings, the process uses procedural tex-

ture which provides various colors for the walls, albeit not identical to reality, better than white walls.

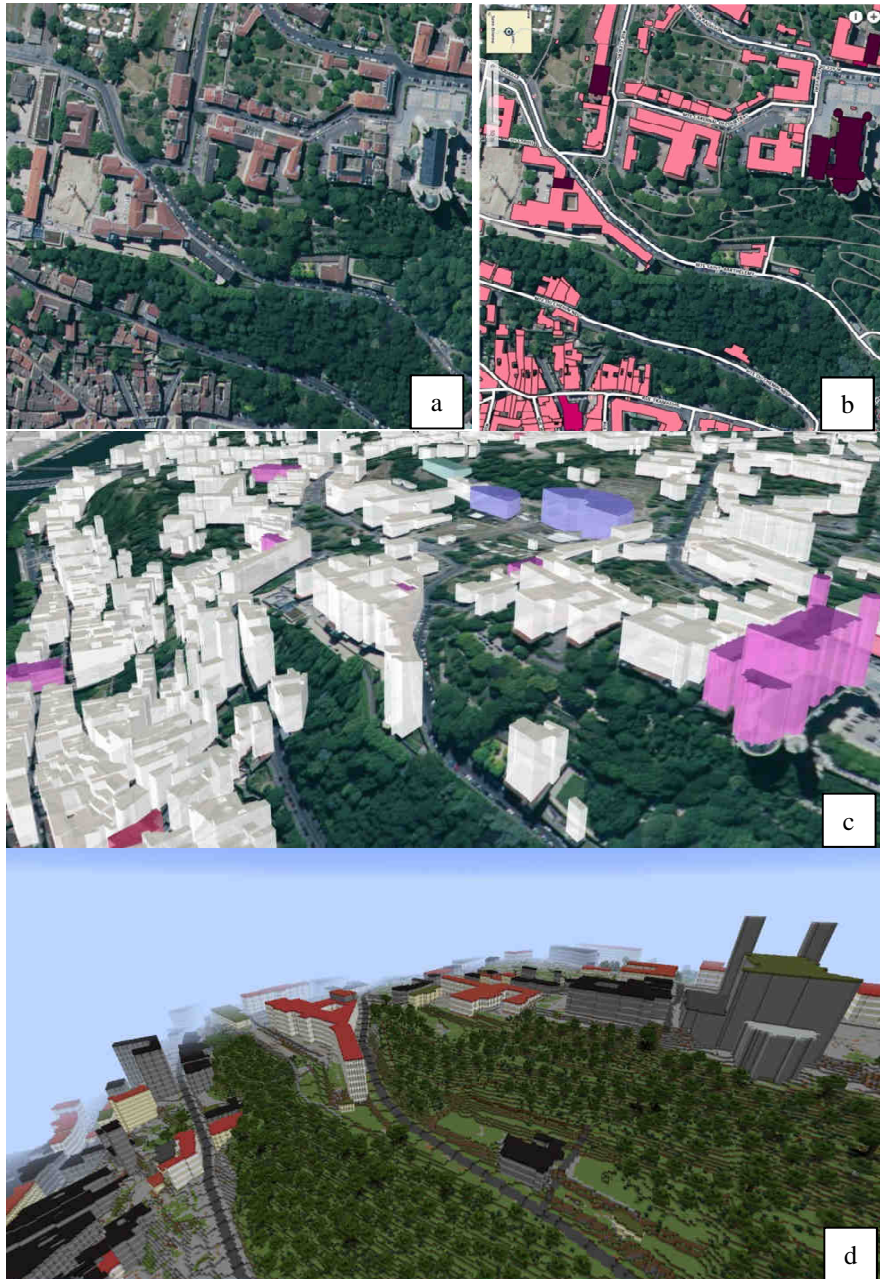


Fig. 3. Different data used to produce Minecraft map on Lyon city (d): BD ORTHO® (a), BD TOPO® (b), RGE ALTI® (3D visualization with BD ORTO® and BD TOPO ®) (c)

3.2 Web interface development

Once the engine stable, a Web application was developed to put the whole workflow together. The front-end is running OpenLayers, and relying on the API Géoportail to load the cartographic visualization assets (with WMTS). This allows the users to navigate through the French territory, to select the location they would like to be converted into a Minecraft map, and to provide their e-mail address (which will be used to ship the generated map to them).

Due to the long computing time needed to generate a map (three to six hours, in average to compute a Minecraft map), an asynchronous solution was chosen: the back-end (coded in PHP) launches the engine as soon as possible, and delivers the map to the users as a downloadable set of files. This is performed on the cloud, by the company Intrinsec.

In order to minimize the risk of breakdown, some solutions were introduced to limit the number of maps computed each day (usually 50 maps a day, increasable if necessary).

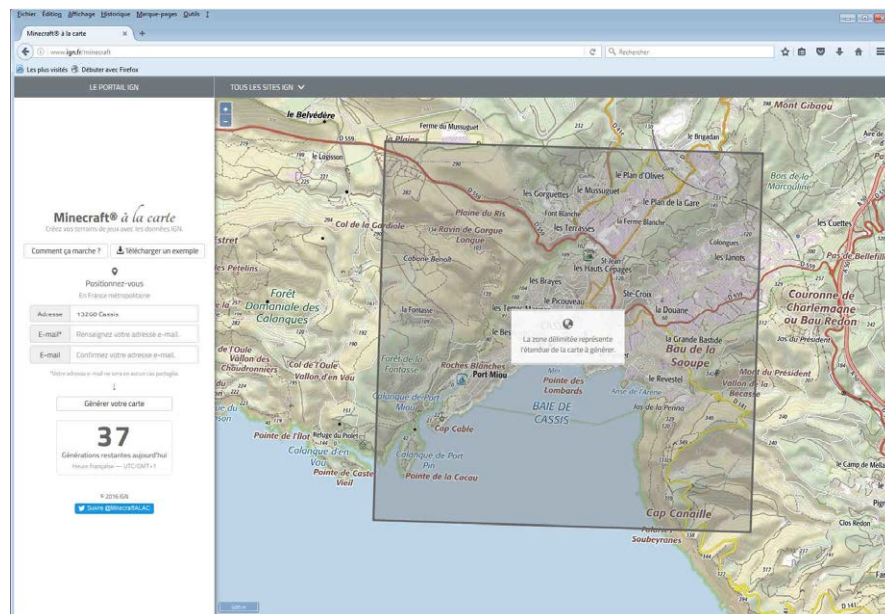


Fig. 4. Web interface for the service Minecraft® on Demand

4. Exploitation

The web service was opened in June 2016, during the French festival *Futur en Seine* on new technologies. A lot of visitors discovered this new service, free of charge, and could experiment it, in particular young people. During two weeks, at the beginning, the limit (150) of Minecraft maps that we provided with this service for each day was reached in less than 2 hours, after midnight.



Fig. 5. Young public on IGN stand for the festival *Futur en Seine* when the service Minecraft® on Demand was opened in June 2016

To date (in March 2017), 10,000 Minecraft maps have been provided to players by the service even if IGN has not done an important effort of communications to promote this service: video on YouTube (https://youtu.be/vl_MEz52jA), announcements on IGN website, news and papers, news on social networks and account on twitter (@MinecraftALAC). More than 3,000 cities (10% of French cities) have been downloaded and around 7,000 email addresses has been used.

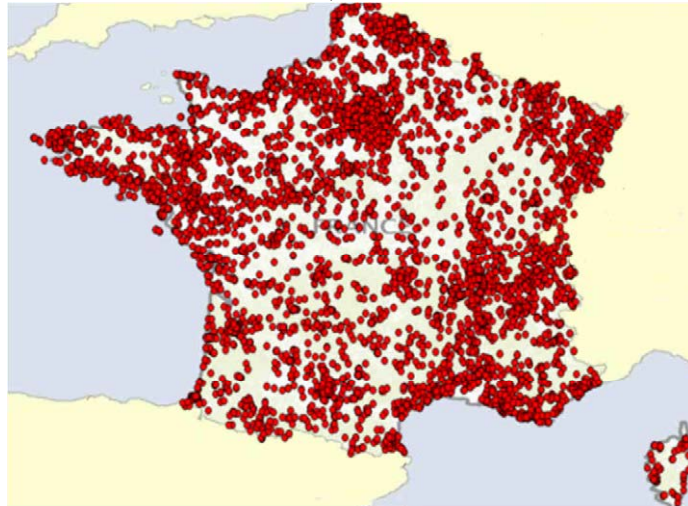


Fig. 6. Distribution of 10,000 Minecraft maps produced between June 2016 and March 2017.

A lot of users have sent emails at IGN to thank for this service, with very positive feedback: *“Thank for this fantastic idea”, “Your project is great; it is a very good initiative, thank to open this service to public”, “The idea is original and the site very simple to use: congratulations”*. The only negative comment has been: *“What a pity: it is only in France!”*

In December 2016, a user, MrChocolatine, published an article on Minecraft.fr, the site of the French Minecraft community to promote this service (MrChocolatine 2016). The result has been immediate with the necessity to increase for many days the number of map to produce each day in order to minimize the number of disappointed users.

The service has been also used for education purposes by teachers and pupils. The first example is provided by Stéphane Cloâtre in the middle school Jeanne d’Arc in the city Fougères. He has proposed to his pupils to build the Bonabry church in the IGN Minecraft map (Cloâtre 2016).



Fig. 7. The Bonabry church at Fougères in Géoportail on the left, in IGN Minecraft map on the center (Source IGN) and, on the right, the result after the building of church by pupils (Source : Stéphane Cloâtre).

Another Minecrafter, Antoine Boeuf started an ambitious project: to build the very popular amusement park in France “Le Puy du Fou” in Minecraft. The IGN map Minecraft on Le Puy du Fou is very helpful for him because all buildings, roads, tracks, hedges, etc. are on the exact positions in the map. First building and garden in the initial map and after the modification are presented in figure 8.



Fig. 8. Le Puy du Fou in Géoportail on the top with the castle and garden on the right, in IGN Minecraft map on the center (Source IGN) and, on the bottom, the result after the building of castle and garden (Source : Antoine Boeuf).

5. Conclusions and perspectives

IGNfab developed a service to produce Minecraft maps on demand with IGN 3D geographic data services. This new service, without any specific promotion, has proven to be highly successful (10,000 maps in 9 months) on a community of young players that IGN had troubles to reach in the past. The Minecraft maps are distributed on whole France and then offer an excellent opportunity to rediscover the geography of France, for both children and parents.

These maps are already used by some teachers and their pupils to create buildings in Minecraft and so to learn by playing. At this moment, in France, the use of Minecraft for education concerns only a few teachers, possibly because it lacks pedagogic tools and the French Minister of Education would prefer to use open source software. That is why IGN is planning to propose maps for the open source software Minetest and new pedagogic tools for teachers, in particular on thematics such as geography and sustainable development teaching.

IGN wishes to experiment this service with other NMAs, in Europe or other continents, which have data flows (WMS and WFS) and will provide data for young people. Many users of the French service are interested to have Minecraft map on Belgium or Switzerland and we are sure that if the service would have an English version, there will be much more demand for other countries. The Danish startup (Geoboxers 2016) is already on this market and proposes similar services, with charge, on the world using SRTM data and OSM data, but without height for buildings. Such kind of services may also be proposed by NMAs with higher quality data and for young people who will be later at least users of NMAs data and, maybe, workers in NMAs or in GIS.

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